discharge from the fine wire. In this corona discharge the air molecules are dissociated into ions and these charged ions quickly attach themselves to the particles of dust or tar. The intense electric field between the two electrodes then drags the particles of dust or tar to the large electrode, where they are deposited.

W. S. Franklin

A LOCAL MAGNETIC STORM

In Science, of March 21, reference is made to a paper just published by the Academy of Science of St. Louis with the above title. In this paper evidence is presented to show that atmospheric ions tend to set like magnets along the lines of the earth's magnetic field. The effect of gusts of wind in disturbing these ions, and in thus producing continual swaying of the lines of force due to variations in permeability, is pointed out.

A more local and somewhat similar magnetic storm may be artificially produced as follows:

Suspend a needle on a silk fiber. Provide it with a mirror, telescope and scale. Partially compensate the effect of the earth's field by bar magnets set in parallel position. Place two bar magnets on opposite sides of the needle, as in the Gaussian method of deflection. Place a plate of glass over one magnet, and sprinkle iron filings upon it. The deflecting effect of that magnet is increased. The needle no longer lies in the magnetic meridian. Balance the effect on the needle by adjustment of the other deflecting magnet and tap the plate. The permeability of the space around the magnet is again increased. A new readjustment may be made. Disturb the iron filings by means of a brush, applied to any small area of the plate. A magnetic storm is thus produced. If the filings were free to move without friction, they would all respond to the disturbance. The needle does respond. If the filings are made to accumulate near the poles, the deflecting effect of the magnet is greatly increased. If the magnet is supported at its middle part so that it is lifted above the plate of glass, the poles may be loaded with iron filings. The apparent magnetic moment of the bar may thus be increased about 8 or 10 per cent. Such a magnetic storm as is thus produced in the surrounding space appears to be similar to that produced in the field of the earth, when atmospheric ions accumulate around the magnetic poles of the earth. If any of these Faraday lines are disturbed, they are all disturbed. The balanced needle tells the story.

It seems very probable that the daily variations in the earth's field may be explained as due to this change in permeability brought about by ionization of the air by sunlight. The lines of force sway in opposite directions during the forenoon and afternoon of each day, their lateral motion being greatest in the equatorial belt. There is also apparently a similar swaying in a vertical direction.

In the forenoon the north end of the needle swings towards the west in the northern hemisphere, while the south pole swings towards the west in the southern. In the equatorial belt the needle suffers no change. These daily variations are modified by summer and winter conditions, as they should be if the above explanation is valid.

Francis E. Nipher

PLUS AND MINUS

In a review of my book, "On the Foundation and Technic of Arithmetic," in Science, April 18, 1913, Professor Cajori, after quoting a sentence, says:

> In view of the fact that historians have been in doubt as to the exact origin of + and —, the authority for Halsted's categorical statement would be interesting.

Hoping the readers of Science may be of the professor's mind, I venture an outline.

Minus, as the oral rendering of the symbol —, takes a sense which did not exist in Latin of any period. Murray says it probably originated in the commercial language of the middle ages. In Germany the Latin words *plus* and *minus* were used by merchants to mark an excess or deficiency in weight or measure. The earliest known examples of the